



843.43861X00

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: T. OKAMOTO, et al

Serial No.: 10/849,038

Filed: May 20, 2004

For: DISK ARRAY APPARATUS AND CONTROL METHOD FOR THE  
SAME

**PETITION TO MAKE SPECIAL**  
**UNDER 37 CFR §1.102(MPEP §708.02)**

**MS Petition**

Commissioner for Patents  
P.O. Box 1450  
Alexandria, VA 22313-1450

August 26, 2005

Sir:

Applicants hereby petition the Commissioner to make the above-identified application special in accordance with 37 CFR §1.102(d). Pursuant to MPEP §708.02(VIII), Applicants state the following.

**(A) This Petition is accompanied by the fee set forth in 37 CFR §1.17(h).**

The Commissioner is hereby authorized to charge any additional payment due, or to credit any overpayment, to Deposit Account No. 50-1417.

**(B) All claims are directed to a single invention.**

If the Office determines that all claims are not directed to a single invention, Applicant will make an election without traverse as a prerequisite to the grant of special status in conformity with established telephone restriction practice.

**(C) A pre-examination search has been conducted.**

The search was directed towards a storage system. In particular, the search was directed towards a disk array apparatus and control method for the same. With reference to the disclosure, FIG. 1 illustrates a disk array apparatus provided with a disk control apparatus 200 and a disk driving apparatus 300. See pg. 12, line. 8-10. The disk control apparatus 200 comprises channel controllers 210, a shared memory 220, a cache memory 230, disk controllers 240, a service processor 250, and a switch 260. See pg. 16, line. 5-8. The shared memory 220 and the cache memory 230 are storage memories for shared use among the channel controllers 210 and the disk controllers 240. See pg. 17, line. 5-7. When an error is caused in writing or reading data into or from the disk drives 310, writing or reading is repeated again after the reading or writing has been normally completed. See pg. 25, line. 1-3. As illustrated in FIG. 11, pieces of drive information 2201 through 2205 stored in shared memory 220 comprise write pending data size 2321, response time pointer, 2322, average response time 2323, drive state 2324, and response times 2331. See pg. 32, line. 19-27. FIG. 12 illustrates the operations for a read request when the disk drive (D1) 311 cannot be used. See pg. 33, line. 5-7. It is first determined whether the disk drive (D1) 311 can be used by referring to the information 2426 on the drive information 2201 in shared memory 220. See pg. 33, line. 8-10. If this drive is not usable, the data is read from redundant drives 312, 313, and 314 and the pieces of data in disk drive (D1) 311 are regenerated from the above data to store them in the read data 2311 on the cache memory. See pg. 33, line.

12-22. FIG. 20 illustrates an example of processing of delay in a disk drive after completion of a data transfer of disk drive (D1) 311. An average response time Q3 is first obtained for the other disk drives 312, 313, 314 using the drive information 2202, 2203, and 2204. See pg. 42, line. 14-17. If the average response time of the drive (D1) 311 is larger than Q3 multiplied by the average response time differential multiple (n3), then transition processing is blocked for the disk drive (D1) 311.

The search of the above features was conducted in the following areas:

<u>Class</u>	<u>Subclasses</u>
711	114
714	1, 2, 25, 42, 47, and 100

Additionally, a computer database search was conducted on the USPTO systems EAST and WEST.

**(D) The following is a list of the references deemed most closely related to the subject matter encompassed by the claims:**

<u>U.S. Patent Number</u>	<u>Inventors</u>
5,761,411	Teague et al
6,061,761	Bachmat
6,366,981	Koike
6,611,896	Mason, Jr. et al
6,715,054	Yamamoto

<u>U.S. Patent Application Publication No.</u>	<u>Inventor(s)</u>
2001/0054133	Murotani et al.

A copy of each of these references (as well as other references uncovered during the search) is enclosed in an accompanying IDS.

**(E) It is submitted that the present invention is patentable over the references for the following reasons.**

It is submitted that the cited references, whether taken individually or in combination with each other, fail to teach or suggest the invention as claimed. In particular, the cited references, at a minimum, fail to teach or suggest as recited in the claims:

a first feature of the present invention as recited in independent claims 1 and 11 wherein the storage device control sections monitor the storing areas in which a request for writing or reading data into or from the plurality of storage devices forming the logical storage areas is stored and among the plurality of storage devices forming the logical storage areas, the storage device control sections specifies a storage device, for which a number of repeated times is large, and block the specified storage device.

Further, the cited references fail to teach or suggest the above noted features of the present invention when taken in combination with other limitations recited in the claims.

The references considered most closely related to the claimed invention are briefly discussed below:

Teague (U.S. Patent No. 5,761,411) relates to a method for performing disk fault prediction operations. FIG. 1 illustrates a computer system 10

configured for predicting drive failures of a storage device 14. The host computer 12 is coupled to the storage device 14 by a physical interface 16. The storage device 14 includes a drive attribute values sector 20 in which drive attributes considered to be key indicators of impending failures of the storage device 14 are periodically stored and a warranty failure thresholds sector 22 in which limits for each drive attribute value are set. To perform drive failure prediction management operations, an execute drive failure prediction command must be issued to the storage device 14. Data which is useful to drive failure prediction is either collected on-line during normal operations of the storage device 14 or off-line after interrupting normal operations of the storage device 14. FIG. 7 illustrates the method of predicting imminent failure of an ATA disk drive in greater detail. The contents of the current attribute values held in the volatile memory are periodically transferred to the storage device 14 where they are stored in the drive attribute values sector 20 as saved attribute values. The contents of the normalized attribute value byte 58 are compared to the contents of the warranty failure threshold byte 80 to determine whether the normalized attribute value has crossed the threshold value for that attribute. If it is determined at step 112 that the threshold has been crossed, the method proceeds to step 116 where an alert is generated indicating imminent failure of the storage device 14.

Teague at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11, and

further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Bachmat (U.S. Patent No. 6,061,761) relates to a method for exchanging logical volumes in a disk array storage device in response to statistical analyses and preliminary testing. FIG. 1 illustrates a disk array system 30 that includes a data memory system with a number of data storage devices or physical disk storage devices 31A, 31B, 31C, 31D and 31E, and a system memory 32 with a cache memory 33. The system 30 also includes several device controllers 34A, 34B, 34C, 34D and 34E connected to corresponding physical disk storage devices 31A through 31E. A load balance program 51 for determining appropriate reallocations of logical volumes on physical disks relies upon information supplied from the performance monitor 50, which retrieves statistics from each cache memory manager on a periodic basis. The load balance program 51 generates from that collected monitored performance a reallocation or exchange of a pair of logical volumes. The load balancer program 51 utilizes the accumulated statistics for obtaining the activity for each physical disk drive as if those two logical volumes had been exchanged and control then branches to step 72 to define a statistical variance for each configuration. In step 73 the load balancer program 51 selects a logical volume pair that produces the minimum statistical variance and proceeds to exchange the logical volumes in step 77.

Bachmat at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11,

and further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Koike (U.S. Patent No. 6,366,981) relates to a disk array apparatus having a presupposed response time and a number of disc units. FIG. 1 illustrates a disk array apparatus 2 with a plurality of disk units (DKU1 to DKU6) 10 and a disk array controller 3. The array controller 3 includes a performance detector 8, a correction value generator 7, and a response timing corrector 5. When the performance detector 8 detects that the array controller is connected to a disk unit 10 having no correction value loaded in the correction value memory 6, the performance detector 8 checks the performance characteristic of the disk unit 10. Upon completion of this check, the check result is passed to the correction value generator 7. The correction value generator 7 compares the check result with a reference value so as to calculate a performance correction value of this physical disc unit, and passes a calculation result to the correction value memory 6. The correction value memory 6 stores the correction value of the disc unit 10. When an I/O is received from a host apparatus, the array controller 3 identifies a physical disc unit 10 to which this access is made. The response timing corrector 5, upon reception of an end report from the disk unit 10, sends the end report to the host apparatus at the timing determined according to the correction value. Thus, even when a different type of physical disc unit is mounted, the access performance from a host apparatus can be maintained consistent.

Koike at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11, and

further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Mason (U.S. Patent No. 6,611,896) relates to a dynamic mirror service policy with seek adjustment in a non-physical mirrored storage environment. FIG. 1 illustrates a data processing system 10 including a plurality of host computers 12 connected to a data storage system 14. The data storage system 14 is a mass storage system having a controller 16 coupled to a plurality of physical storage devices shown as disk storage devices 18. Each of the physical devices 18 is logically divided into a plurality of units. With reference to the data storage system 14, it is assumed that mirroring exists at the logical volume level, but not necessarily at the physical device level. The controller 16 is suitably adapted to perform a seek minimization operation to adjust seek activity in a data storage system in which the logical volumes, but not the physical devices, are mirrored. As shown in FIG. 4, each disk adapter 40 includes a nonvolatile memory 52, which further includes a firmware 56 composed of a mirror service policy process 60 and a seek minimizer. FIG. 5 illustrates the seek adjustment process 80. The process 80 computes a seek function value  $S$  (according to Eq. 1) for each of the physical devices, sums all computed  $S$  values, and sorts the physical devices by the computed  $S$  values. The process then simulates each possible mirror policy change to determine the optimal change and implements the policy change in step 106.

Mason at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11, and



further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Yamamoto (U.S. Patent No. 6,715,054) relates to dynamic reallocation of physical storage. FIG. 1 illustrates a storage system 10 for handling I/O data communication between a number of host processing systems 12 and a physical storage 14, comprising disk units 16. The storage system 10 includes a controller unit 20, with associated memory/cache unit 22 that operates to control data transfers between the host system 12 and the physical storage 14. Data structures are maintained in the memory/cache unit 22 to implement a logical volume management system that groups logical volumes into one or more "coupling groups." Each coupling group comprises one or more logical volumes. The reconfiguration process 140 illustrated in FIG. 10 operates to determine whether the number of logical volumes of a coupling group should be increased or decreased based upon the information collected by the information collection process 132. First, in step 142, the cumulative times of each of the disk units of a coupling group are examined. If the cumulative time value for one or more of the disk units is found to be greater than some predetermined value, the reconfiguration process 140 will move to step 148 where the number of received read and write requests of the logical volumes corresponding to the over-utilized disk units is examined. Then, it is decided, in step 150, whether or not to increase the number of logical volumes for the coupling group. If, on the other hand, the number of read and write requests is less than some predetermined value, the system decides in step 156 whether to decrease the number of logical

volumes. If the answer to either step 150 or 156 is yes, the coupling group redefinition process is called at step 152.

Yamamoto at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11, and further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Murotani (U.S. Patent Application Publication No. 2001/0054133) relates to a data storage system and method of hierarchical control thereof. FIG. 1 illustrates a system with a host unit 1 executing two or more applications and disk array controllers 2, 3, and 4 connected by a Fabric Switch 6 through a Fibre Channel. External manager 5 obtains access data by compiling access data managed by each of the controllers. The procedure by which the external manager selects a migration target logical volume is illustrated in FIG. 3. In step 25, a user assigns to the external manager an application whose performance can be improved by data migration and assigns a priority percentage to the application. In processing steps 27 to 29, the external manager works out a decision index for executing data migration for each high priority application, in sequence. In step 31 of FIG. 4, external manager 5 refers to the list of the logical volumes that are the performance bottlenecks of each application selected and sets a migration target flag to 1 at step 32 if there is at least one logical volume in the list. External manager 5 then confirms that the bottleneck is caused by the physical drive and that the load can be equilibrated by the data migration of each

logical volume registered in the bottleneck logical volume list for each application and prepares the data migration instruction.

Murotani at a minimum does not teach or suggest the above described first feature of the present invention as recited in independent claims 1 and 11, and further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims.

Therefore, since the cited references at a minimum fail to teach or the above described first feature of the present invention as recited in independent claims 1 and 11, and further fail to teach or suggest this feature of the present invention in combination with the other limitations recited in each of the independent claims, it is submitted that all of the claims are patentable over the cited references whether said references are taken individually or in combination with each other.

#### **F. Conclusion**

Applicant has conducted what it believes to be a reasonable search, but makes no representation that "better" or more relevant prior art does not exist. The United States Patent and Trademark Office is urged to conduct its own complete search of the prior art, and to thoroughly examine this application in view of the prior art cited herein and any other prior art that the United States Patent and Trademark Office may locate in its own independent search. Further, while Applicant has identified in good faith certain portions of each of the references listed herein in order to provide the requisite detailed discussion of how the claimed subject matter is patentable over the references, the United

States Patent and Trademark Office should not limit its review to the identified portions but rather, is urged to review and consider the entirety of each reference, and not to rely solely on the identified portions when examining this application.

In view of the foregoing, Applicant requests that this Petition to Make Special be granted and that the application undergo the accelerated examination procedure set forth in MPEP 708.02 VIII.

**G. Fee (37 C.F.R. 1.17(i))**

The fee required by 37 C.F.R. § 1.17(i) is to be paid by:

☒ the Credit Card Payment Form (attached) for \$130.00.

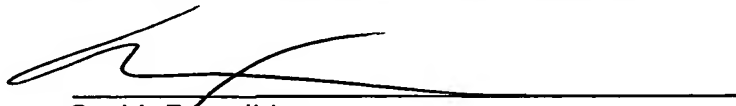
☐ charging Account \_\_\_\_\_ the sum of \$130.00.

A duplicate of this petition is attached.

Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, or credit any overpayment of fees, to the deposit account of MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C.,  
Deposit Account No. 50-1417 (843.43861X00).

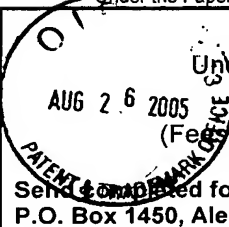
Respectfully submitted,

MATTINGLY, STANGER, MALUR & BRUNDIDGE, P.C.

  
\_\_\_\_\_  
Carl I. Brundidge  
Reg. No. 29,621

CIB/jdc  
(703) 684-1120

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it contains a valid OMB control number.

 <p><b>PETITION FEE</b> Under 37 CFR 1.17(f), (g) &amp; (h) <b>TRANSMITTAL</b> (Fees are subject to annual revision)</p> <p>Send completed form to: Commissioner for Patents P.O. Box 1450, Alexandria, VA 22313-1450</p>	<b>Application Number</b>	<b>10/849,038</b>
	<b>Filing Date</b>	<b>May 20, 2004</b>
	<b>First Named Inventor</b>	<b>T. OKAMOTO, et al</b>
	<b>Art Unit</b>	
	<b>Examiner Name</b>	
	<b>Attorney Docket Number</b>	<b>843.43861X00</b>

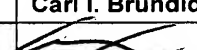
Enclosed is a petition filed under 37 CFR §1.102(d) that requires a processing fee (37 CFR 1.17(f), (g), or (h)). Payment of \$ **130.00** is enclosed.

This form should be included with the above-mentioned petition and faxed or mailed to the Office using the appropriate Mail Stop (e.g., Mail Stop Petition), if applicable. For transmittal of processing fees under 37 CFR 1.17(i), see form PTO/SB/17i.

**Payment of Fees** (small entity amounts are NOT available for the petition (fees))

- ☒ The Commissioner is hereby authorized to charge the following fees to Deposit Account No. **50-1417**:
- ☐ petition fee under 37 CFR 1.17(f), (g) or (h) ☒ any deficiency of fees and credit of any overpayments
- Enclose a duplicative copy of this form for fee processing.
- ☐ Check in the amount of \$ \_\_\_\_\_ is enclosed.
- ☒ Payment by credit card (From PTO-2038 or equivalent enclosed). Do not provide credit card information on this form.

<b>Petition Fees under 37 CFR 1.17(f):</b>	<b>Fee \$400</b>	<b>Fee Code 1462</b>
For petitions filed under:		
§ 1.53(e) - to accord a filing date.		
§ 1.57(a) - to according a filing date.		
§ 1.182 - for decision on a question not specifically provided for.		
§ 1.183 - to suspend the rules.		
§ 1.378(e) for reconsideration of decision on petition refusing to accept delayed payment of maintenance fee in an expired patent.		
§ 1.741(b) - to accord a filing date to an application under §1.740 for extension of a patent term.		
<b>Petition Fees under 37 CFR 1.17(g):</b>	<b>Fee \$200</b>	<b>Fee code 1463</b>
For petitions filed under:		
§1.12 - for access to an assignment record.		
§1.14 - for access to an application.		
§1.47 - for filing by other than all the inventors or a person not the inventor.		
§1.59 - for expungement of information.		
§1.103(a) - to suspend action in an application.		
§1.136(b) - for review of a request for extension of time when the provisions of section 1.136(a) are not available.		
§1.295 - for review of refusal to publish a statutory invention registration.		
§1.296 - to withdraw a request for publication of a statutory invention registration filed on or after the date the notice of intent to publish issued.		
§1.377 - for review of decision refusing to accept and record payment of a maintenance fee filed prior to expiration of a patent.		
§1.550(c) - for patent owner requests for extension of time in <u>ex parte</u> reexamination proceedings.		
§1.956 - for patent owner requests for extension of time in <u>inter partes</u> reexamination proceedings.		
§ 5.12 - for expedited handling of a foreign filing license.		
§ 5.15 - for changing the scope of a license.		
§ 5.25 - for retroactive license.		
<b>Petition Fees under 37 CFR 1.17(h):</b>	<b>Fee \$130</b>	<b>Fee Code 1464</b>
For petitions filed under:		
§1.19(g) - to request documents in a form other than that provided in this part.		
§1.84 - for accepting color drawings or photographs.		
§1.91 - for entry of a model or exhibit.		
§1.102(d) - to make an application special.		
§1.138(c) - to expressly abandon an application to avoid publication.		
§1.313 - to withdraw an application from issue.		
§1.314 - to defer issuance of a patent.		

<b>Name (Print/Type)</b>	<b>Carl I. Brundidge</b>	<b>Registration No. (Attorney/Agent)</b>	<b>29,621</b>
<b>Signature</b>		<b>Date</b>	<b>August 26, 2005</b>

This collection of information is required by 37 CFR 1.114. The information is required to obtain or retain a benefit by the public which is to file (and by the USPTO to process) an application. Confidentiality is governed by 35 U.S.C. 122 and 37 CFR 1.14. This collection is estimated to take 12 minutes to complete, including gathering, preparing, and submitting the completed application form to the USPTO. Time will vary depending upon the individual case. Any comments on the amount of time you require to complete this form and/or suggestions for reducing this burden, should be sent to the Chief Information Officer, U.S. Patent and Trademark Office, U.S. Department of Commerce, P.O. Box 1450, Alexandria, VA 22313-1450. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.